WHAT IS CLAIMED IS:

1. A method for the production of alkyl aromatic hydrocarbons, comprising:

introducing a first hydrocarbon stream comprising olefins and paraffins into an isomerization unit, wherein the isomerization unit is configured to isomerize at least a portion of linear olefins in the first hydrocarbon stream to branched olefins, and wherein at least a portion of the unreacted components of the first hydrocarbon stream and at least a portion of the produced branched olefins form a second hydrocarbon stream;

introducing at least a portion of the second hydrocarbon stream and aromatic hydrocarbons into an alkylation unit, wherein the alkylation unit is configured to alkylate at least a portion of the aromatic hydrocarbons with at least a portion of the olefins in the second hydrocarbon stream to produce alkyl aromatic hydrocarbons, wherein at least a portion of the produced alkyl aromatic hydrocarbons comprise a branched alkyl group, and wherein at least a portion of the unreacted components of the second hydrocarbon stream, at least a portion of the aromatic hydrocarbons and at least a portion of the produced alkyl aromatic hydrocarbons form an alkylation reaction stream;

separating alkyl aromatic hydrocarbons from the alkylation reaction stream to produce an unreacted hydrocarbons stream and an alkyl aromatic hydrocarbons stream; the unreacted hydrocarbons stream comprising at least a portion of the unreacted components of the second hydrocarbon stream and aromatic hydrocarbons;

separating at least a portion of the paraffins and at least a portion of the olefins from the unreacted hydrocarbons stream to produce an aromatic hydrocarbons stream and a paraffins and unreacted olefins stream; and

introducing at least a portion of the paraffins and unreacted olefins stream into a dehydrogenation unit, wherein the dehydrogenation unit is configured to dehydrogenate at

least a portion of paraffins in the paraffins and unreacted olefins stream to produce olefins, and wherein at least a portion of the produced olefins exit the dehydrogenation unit to form an olefinic hydrocarbon stream; and

introducing at least a portion of the olefinic hydrocarbon stream into the isomerization unit.

2. The method of claim 1, wherein the first hydrocarbon stream is produced from an olefin oligomerization process.

3. The method of claim 1, wherein the first hydrocarbon stream is produced from a Fischer-Tropsch process.

4. The method of claim 1, wherein the first hydrocarbon stream comprises olefins and paraffins having a carbon number from 10 to 13.

5. The method of claim 1, wherein the first hydrocarbon stream comprises olefins and paraffins having a carbon number from 10 to 16.

6. The method of claim 1, wherein the isomerization unit is operated at a reaction temperature between about 200 °C and about 500 °C.

7. The method of claim 1, wherein the isomerization unit is operated at a reaction pressure between about 0.1 atmosphere and about 10 atmospheres.

8. The method of claim 1, wherein at least a portion of the branched olefins comprise an average number of branches per total olefin molecules of at least 0.7.

9. The method of claim 1, wherein at least a portion of the branched olefins comprise methyl and ethyl branches.

10. The method of claim 1, wherein at least a portion of the branched olefins comprise an average number of branches per total olefin molecules of less than about 2.5.

11. The method of claim 1, wherein at least a portion of the branched olefins comprise an average number of branches per total olefin molecules of between about 0.7 and about 2.0.

12. The method of claim 1, wherein at least a portion of the branched olefins comprise an average number of branches per total olefin molecules of between about 0.7 and about 1.5.

13. The method of claim 1, wherein at least a portion of the branched olefins comprise an average number of branches per total olefin molecules of between about 1.0 and about 1.5.

14. The method of claim 1, wherein greater than about 50 percent of the branched groups on the branched olefins are methyl groups.

15. The method of claim 1, wherein less than about 10 percent of the branched groups on the branched olefins are ethyl groups.

16. The method of claim 1, wherein less than about 5 percent of the branched groups on the branched olefins are groups other than methyl or ethyl groups.

17. The method of claim 1, wherein the branched olefins have less than about 0.5 percent aliphatic quaternary carbon atoms.

18. The method of claim 1, wherein the branched olefins have less than about 0.3 percent aliphatic quaternary carbon atoms.

19. The method of claim 1, wherein the alkylation unit is configured to produce greater than about 50 percent of monoalkylated aromatic hydrocarbons.

20. The method of claim 1, wherein the alkylation unit is configured to produce greater than about 85 percent of monoalkylated aromatic hydrocarbons.

21. The method of claim 1, wherein a molar ratio of the aromatic hydrocarbons to the branched olefins is between about 0.1 and about 2.0 in the alkylation unit.

22. The method of claim 1, wherein the alkylation unit is operated at a reaction temperature between about 30 °C and about 300 °C.

23. The method of claim 1, wherein the aromatic hydrocarbons comprise benzene.

24. The method of claim 1, wherein the alkyl aromatic hydrocarbons comprise alkyl benzenes.

25. The method of claim 1, wherein the branched alkyl groups of the alkyl aromatic hydrocarbons comprise 0.5 percent or less aliphatic quaternary carbon atoms, and an average number of branches per alkyl group of at least 0.7, the branches comprising methyl and ethyl branches.

26. The method of claim 1, further comprising adjusting a ratio of olefins to paraffins introduced into the isomerization unit by adding at least a portion of a paraffinic hydrocarbon stream into the isomerization unit.

27. The method of claim 1, further comprising:

adjusting a ratio of olefins to paraffins introduced into the isomerization unit by combining a paraffinic hydrocarbon stream with at least a portion of the first hydrocarbon stream upstream of the isomerization unit to form a combined stream; and

introducing the combined stream into the isomerization unit.

28. The method of claim 1, further comprising adjusting a ratio of olefins to paraffins introduced into the alkylation unit by adding at least a portion of a third hydrocarbon stream into the alkylation unit.

29. The method of claim 1, further comprising adjusting a ratio of olefins to paraffins introduced into the alkylation unit by adding at least a portion of a third hydrocarbon stream into the alkylation unit, wherein the third hydrocarbon stream comprises greater than about 90 percent paraffins by weight.

30. The method of claim 1, further comprising:

adjusting a ration of olefins to paraffins introduced into the alkylation unit by combing at least a portion of a third hydrocarbon stream with at least a portion of the second hydrocarbon stream upstream of the alkylation unit to form a combined stream; and

introducing the combined stream into the alkylation unit.

31. The method of claim 1, further comprising:

adjusting a ratio of olefins to paraffins introduced into the alkylation unit by combining at least a portion of a third hydrocarbon stream with at least a portion of the second hydrocarbon stream upstream of the alkylation unit to form a combined stream, wherein the third hydrocarbon stream comprises greater than about 90 percent paraffins by weight; and

introducing the combined stream into the alkylation unit.

32. The method of claim 1, further comprising:

adjusting a ratio of olefins to paraffins introduced into the alkylation unit by combining at least a portion of a third hydrocarbon stream with at least a portion of the second hydrocarbon stream upstream of the alkylation unit to form a combined stream, wherein the third hydrocarbon stream comprises greater than about 80 percent paraffins by weight; and

introducing the combined stream into the alkylation unit.

33. The method of claim 1, further comprising:

adjusting a ratio of olefins to paraffins introduced into the alkylation unit by combining at least a portion of a third hydrocarbon stream with at least a portion of the second hydrocarbon stream upstream of the alkylation unit to form a combined stream, wherein the third hydrocarbon stream comprises between about 80 percent to about 95 percent paraffins by weight; and

introducing the combined stream into the alkylation unit.

34. The method of claim 1, further comprising:

adjusting a ratio of olefins to paraffins introduced into the alkylation unit by combining at least a portion of a third hydrocarbon stream with at least a portion of the second hydrocarbon stream upstream of the alkylation unit to form a combined stream, wherein the third hydrocarbon stream comprises linear olefins; and

introducing the combined stream into the alkylation unit.

35. The method of claim 1, further comprising:

adjusting a ratio of olefins to paraffins introduced into the alkylation unit by combining at least a portion of a third hydrocarbon stream with at least a portion of the second hydrocarbon stream upstream of the alkylation unit to form a combined stream, wherein at least a portion of the second hydrocarbon stream comprises branched olefins; and

introducing the combined stream into the alkylation unit.

36. The method of claim 1, further comprising:

adjusting a ratio of olefins to paraffins introduced into the alkylation unit by combining at least a portion of a third hydrocarbon stream with at least a portion of the second hydrocarbon stream upstream of the alkylation unit to form a combined stream, wherein at least a portion of the third hydrocarbon stream comprises linear olefins and at least a portion of the second hydrocarbon stream comprises branched olefins; and

introducing the combined stream into the alkylation unit.

37. The method of claim 1, further comprising:

adjusting a ratio of olefins to paraffins introduced into the isomerization unit by combining at least a portion of a paraffinic hydrocarbon stream with at least a portion of the first hydrocarbon stream upstream of the isomerization unit to form a combined stream;

introducing the combined stream into the isomerization unit;

adjusting a ratio of olefins to paraffins introduced into the alkylation unit by combining at least a portion of a third hydrocarbon stream with at least a portion of the second hydrocarbon stream upstream of the alkylation unit to form a combined stream; and

introducing the combined stream into the alkylation unit.

38. The method of claim 1, wherein the dehydrogenation unit is operated at a temperature between about 300 °C and about 700 °C.

39. The method of claim 1, wherein the dehydrogenation unit is operated at a pressure between about 1.0 atmosphere and about 15 atmospheres.

40. The method of claim 1, wherein a residence time of at least a portion of the unreacted hydrocarbons stream in the dehydrogenation unit is such that the conversion level of the paraffins in the unreacted hydrocarbons stream composition to olefins is less than about 50 mole percent.

41. The method of claim 1, wherein introducing the olefinic hydrocarbon stream into the isomerization unit comprises combining at least a portion of the olefinic hydrocarbon stream with at least a portion of the first hydrocarbon stream to produce a combined stream upstream from the isomerization unit, and introducing at least a portion of the combined stream into the isomerization unit.

42. The method of claim 1, further comprising separating non-converted paraffins from the olefinic stream and introducing at least a portion of the non-converted paraffins separated from the olefinic stream into the dehydrogenation unit.

43. The method of claim 1, further comprising introducing at least a portion of the alkyl aromatic hydrocarbon stream into a sulfonation unit, wherein the sulfonation unit is configured to sulfonate at least a portion of the alkyl aromatic hydrocarbons in the alkyl aromatic hydrocarbon stream to produce alkyl aromatic sulfonates, wherein at least a portion of the alkyl aromatic sulfonates produced comprise branched alkyl aromatic sulfonates.

44. A method for the production of alkyl aromatic hydrocarbons, comprising:

introducing a first hydrocarbon stream comprising olefins and paraffins into a dehydrogenation-isomerization unit, wherein the dehydrogenation-isomerization unit is configured to dehydrogenate at least a portion of the paraffins in the first hydrocarbon stream to olefins, and wherein the dehydrogenation-isomerization unit is further configured to isomerize at least a portion of linear olefins to branched olefins, and wherein at least a portion of the unreacted components of the first hydrocarbon stream and at least a portion of the products of the dehydrogenation and isomerization reactions form a second hydrocarbon stream, the second hydrocarbon stream comprising olefins and paraffins, and wherein at least a portion of the olefins in the second hydrocarbon stream are branched olefins; and

introducing at least a portion of the second hydrocarbon stream and aromatic hydrocarbons into an alkylation unit, wherein the alkylation unit is configured to alkylate at least a portion of the aromatic hydrocarbons with at least a portion of the olefins in the second hydrocarbon stream to produce alkyl aromatic hydrocarbons, wherein at least a portion of the produced alkyl aromatic hydrocarbons comprise a branched alkyl group.

45. The method of claim 44, wherein the first hydrocarbon stream is produced from an olefin oligomerization process.

46. The method of claim 44, wherein the first hydrocarbon stream is produced from a Fischer-Tropsch process.

47. The method of claim 44, wherein the first hydrocarbon stream comprises olefins and paraffins having carbon numbers from 10 to 16.

48. The method of claim 44, wherein the first hydrocarbon stream comprises olefins and paraffins having carbon numbers from 10 to 13.

49. The method of claim 44, wherein the first hydrocarbon stream comprises an olefin content between about 1 percent and about 50 percent of the total amount of hydrocarbons in the first hydrocarbon stream.

50. The method of claim 44, wherein the first hydrocarbon stream comprises about 80 percent paraffins.

51. The method of claim 44, wherein the dehydrogenation-isomerization unit is operated at a temperature of between about 300 °C and about 500 °C.

52. The method of claim 44, wherein the dehydrogenation-isomerization unit is configured to operate at a pressure of between about 0.10 atmosphere and about 15 atmospheres.

53. The method of claim 44, wherein a residence time at least a portion of the unreacted hydrocarbons stream in the dehydrogenation-isomerization unit is such that the conversion level of the paraffins in the unreacted hydrocarbons stream composition to olefins is less than about 50 mole percent.

54. The method of claim 44, wherein a portion of the branched olefins comprise an average number of branches per total olefin molecules of at least 0.7.

55. The method of claim 44, wherein a portion of the branched olefins comprise methyl and ethyl branches.

56. The method of claim 44, wherein a portion of the branched olefins comprise an average number of branches per total olefin molecules of less than about 2.5.

57. The method of claim 44, wherein a portion of the branched olefins comprise an average number of branches per total olefin molecules of between about 0.7 and about 2.0.

58. The method of claim 44, wherein a portion of the branched olefins comprise an average number of branches per total olefin molecules of between about 0.7 and about 1.5.

59. The method of claim 44, wherein a portion of the branched olefins comprise an average number of branches per total olefin molecules of between about 1.0 and about 1.5.

60. The method of claim 44, wherein greater than about 50 percent of the branched groups on the branched olefins are methyl groups.

61. The method of claim 44, wherein less than about 10 percent of the branched groups on the branched olefins are ethyl groups.

62. The method of claim 44, wherein less than about 5 percent of the branched groups on the branched olefins are neither methyl or ethyl groups.

63. The method of claim 44, wherein the branched olefins have less than about 0.5 percent aliphatic quaternary carbon atoms.

64. The method of claim 44, wherein the branched olefins have less than about 0.3 percent aliphatic quaternary carbon atoms.

65. The method of claim 44, wherein the alkylation unit is configured to produce greater than about 50 percent of monoalkylated aromatic hydrocarbons.

66. The method of claim 44, wherein the alkylation unit is configured to produce greater than about 85 percent of monoalkylated aromatic hydrocarbons.

67. The method of claim 44, wherein a molar ratio of the aromatic hydrocarbons to the branched olefins is between about 0.1 to about 2.0 in the alkylation unit.

68. The method of claim 44, wherein the alkylation unit is operated at a reaction temperature between about 30 °C and about 300 °C.

69. The method of claim 44, further comprising adjusting a ratio of olefins to paraffins introduced into the alkylation unit by adding at least a portion of a third hydrocarbon stream into the alkylation unit.

70. The method of claim 44, further comprising adjusting a ratio of olefins to paraffins introduced into the alkylation unit by adding at least a portion of a third hydrocarbon stream into the alkylation unit, wherein the third hydrocarbon stream comprises greater than about 90 percent paraffins by weight.

71. The method of claim 44, further comprising adjusting a ratio of olefins to paraffins introduced into the alkylation unit by combining at least a portion of a third hydrocarbon stream with at least a portion of the second hydrocarbon stream upstream of the alkylation unit to form a combined stream and introducing the combined stream into the alkylation unit.

72. The method of claim 44, further comprising adjusting a ratio of olefins to paraffins introduced into the alkylation unit by combining at least a portion of a third hydrocarbon stream with at least a portion of the second hydrocarbon stream upstream of the alkylation unit to form a combined stream, wherein the third hydrocarbon stream comprises greater than about 90 percent paraffins by weight; and introducing the mixed stream into the alkylation unit.

73. The method of claim 44, wherein the branched alkyl groups of the alkyl aromatic hydrocarbons comprise 0.5 percent or less aliphatic quaternary carbon atoms, and an average number of branches per alkyl group of at least 0.7, the branches comprising methyl and ethyl branches.

74. The method of claim 44, further comprising:

forming an alkylation reaction stream wherein the alkylation reaction stream comprises at least a portion of the unreacted components of the second hydrocarbon stream, at least a portion of the aromatic hydrocarbons and at least a portion of the produced alkyl aromatic hydrocarbons;

separating alkyl aromatic hydrocarbons from the alkylation reaction stream to produce an unreacted hydrocarbons stream and an alkyl aromatic hydrocarbon stream; the unreacted hydrocarbons stream comprising at least a portion of the unreacted components of the second hydrocarbon stream and aromatic hydrocarbons;

separating at least a portion of the paraffins and at least a portion of the olefins from the unreacted hydrocarbons stream to produce an aromatic hydrocarbons stream and a paraffins and unreacted olefins stream; and

introducing at least a portion of the paraffins and unreacted olefins stream into the dehydrogenation-isomerization unit.

75. The method of claim 74, wherein introducing at least a portion of the paraffins and unreacted olefins stream into the dehydrogenation-isomerization unit comprises combining at least a portion of the paraffins and unreacted olefins stream with at least a portion of the first hydrocarbon stream to produce a combined stream upstream of the dehydrogenation-isomerization unit and introducing at least a portion of the combined stream into the dehydrogenation-isomerization unit.

76. The method of claim 74, further comprising introducing at least a portion of the alkyl aromatic hydrocarbons stream into a sulfonation unit, wherein the sulfonation unit is configured to sulfonate at least a portion of the alkyl aromatic hydrocarbons in the alkyl aromatic hydrocarbons stream to produce alkyl aromatic sulfonates, wherein at least a portion of the alkyl aromatic sulfonates produced comprise branched alkyl aromatic sulfonates.

77. The method of claim 44, wherein the dehydrogenation-isomerization unit comprises a dehydrogenation-isomerization catalyst configured to catalyze both dehydrogenation reactions and isomerization reactions in the dehydrogenation-isomerization unit, the catalyst comprising a hydrogen form of a zeolite have a ferrierite isotypic framework structure, a binder, a coke-oxidizing compound, and a paraffin dehydrogenation promoting compound.

78. The method of claim 77, wherein the coke-oxidizing compound comprises chrome oxide, iron oxide or noble metals or mixtures thereof.

79. The method of claim 77, wherein the coke-oxidizing compound comprises a platinum, palladium, iridium, ruthenium, osmium or rhodium or mixtures thereof.

80. The method of claim 77, wherein the coke-oxidizing compound is a noble metal.

81. The method of claim 77, wherein the paraffin dehydrogenation promoting compound is a noble metal.

82. The method of claim 77, wherein the paraffin dehydrogenation promoting compound is platinum.

83. The method of claim 77, wherein the binder is selected from natural clays, alumina and silica-alumina.

84. The method of claim 77, wherein the binder is alumina.

85. The method of claim 44, wherein the dehydrogenation-isomerization unit comprises a plurality of zones, wherein the plurality of zones comprises a first reaction zone and a second reaction zone, wherein the first reaction zone is configured to dehydrogenate at least a portion of paraffins to olefins, and wherein the second reaction zone is configured to isomerize at least a portion of linear olefins to branched olefins, and wherein at least a portion of the unreacted

components of the first hydrocarbon stream and at least a portion of the products of the dehydrogenation and isomerization reactions form a second hydrocarbon stream.

86. The method of claim 44, wherein the dehydrogenation-isomerization unit comprises a plurality of zones, wherein the plurality of zones comprises a first reaction zone and a second reaction zone, wherein the first reaction zone is configured to dehydrogenate at least a portion of paraffins to olefins, wherein the second reaction zone is configured to isomerize at least a portion of linear olefins to branched olefins; and wherein the first reaction zone is operated at a temperature of between about 300 °C and about 600 °C.

87. The method of claim 44, wherein the dehydrogenation-isomerization unit comprises a plurality of zones, wherein the plurality of zones comprises a first reaction zone and a second reaction zone, wherein the first reaction zone is configured to dehydrogenate at least a portion of paraffins to olefins, wherein the second reaction zone is configured to isomerize at least a portion of linear olefins to branched olefins; and wherein the first reaction zone is operated at a temperature of between about 350 °C and about 550 °C.

88. The method of claim 44, wherein the dehydrogenation-isomerization unit comprises a plurality of zones, wherein the plurality of zones comprises a first reaction zone and a second reaction zone, wherein the first reaction zone is configured to dehydrogenate at least a portion of paraffins to olefins, wherein the second reaction zone is configured to isomerize at least a portion of linear olefins to branched olefins; and wherein the first reaction zone is operated at a total reaction pressure between about 1.0 atmospheres and about 5.0 atmospheres.

89. The method of claim 44, further comprising introducing hydrogen into the first hydrocarbon stream.

90. The method of claim 44, wherein the dehydrogenation-isomerization unit comprises a plurality of zones, wherein the plurality of zones comprises a first reaction zone and a second reaction zone, wherein the first reaction zone is configured to dehydrogenate at least a portion of

paraffins to olefins, wherein the second reaction zone is configured to isomerize at least a portion of linear olefins to branched olefins; and wherein a residence time of at least a portion of the first hydrocarbon stream in the first reaction zone is such that the conversion level of the paraffins to olefins is less than about 50 mole percent.

91. The method of claim 85, further comprising introducing at least a portion of the first hydrocarbon stream exiting the first reaction zone into a heat exchanger, wherein the heat exchanger is configured to remove heat from a portion of the first hydrocarbon stream before it enters the second reaction zone.

92. The method of claim 44, wherein the dehydrogenation-isomerization unit comprises a plurality of zones, wherein the plurality of zones comprises a first reaction zone and a second reaction zone, wherein the first reaction zone is configured to dehydrogenate at least a portion of paraffins to olefins, wherein the second reaction zone is configured to isomerize at least a portion of linear olefins to branched olefins; and wherein the second reaction zone is operated at a temperature range of about 200 °C to about 500 °C.

93. The method of claim 44, wherein the dehydrogenation-isomerization unit comprises a plurality of zones, wherein the plurality of zones comprises a first reaction zone and a second reaction zone, wherein the first reaction zone is configured to dehydrogenate at least a portion of paraffins to olefins, wherein the second reaction zone is configured to isomerize at least a portion of linear olefins to branched olefins; and wherein the second reaction zone is operated at a hydrocarbon partial pressure between about 0.1 atmosphere and about 10 atmospheres.

94. The method of claim 44, wherein the dehydrogenation-isomerization unit comprises a plurality of zones, wherein the plurality of zones comprises a first reaction zone and a second reaction zone, wherein the first reaction zone is configured to dehydrogenate at least a portion of paraffins to olefins, wherein the second reaction zone is configured to isomerize at least a portion of linear olefins to branched olefins; and wherein the second reaction zone is operated at a hydrocarbon partial pressure between about 0.5 atmosphere and about 2 atmospheres.

95. The method of claim 44, wherein the dehydrogenation-isomerization unit comprises a stacked bed catalyst configuration, wherein the stacked bed catalyst comprises a dehydrogenation catalyst and an isomerization catalyst.

96. A method for the production of alkyl aromatic hydrocarbons, comprising:

introducing a first hydrocarbon stream comprising olefins and paraffins into a dimerization unit, wherein the dimerization unit is configured to dimerize at least a portion of the olefins in the first hydrocarbon stream to produce dimerized olefins, and wherein at least a portion of the unreacted components of the first hydrocarbon stream and at least a portion of the produced dimerized olefins form a second hydrocarbon stream, and wherein at least a portion of the dimerized olefins are branched olefins; and wherein the dimerization unit comprises a dimerization catalyst configured to dimerize at least a portion of the olefins, the catalyst comprising nickel oxide; and

introducing at least a portion of the second hydrocarbon stream and aromatic hydrocarbons into an alkylation unit, wherein the alkylation unit is configured to alkylate at least a portion of the aromatic hydrocarbons with at least a portion of the olefins from the second hydrocarbon stream to produce alkyl aromatic hydrocarbons, wherein a least a portion of the produced alkyl aromatic hydrocarbons comprise a branched alkyl group.

97. The method of claim 96, wherein the first hydrocarbon stream is produced from a Fischer-Tropsch process.

98. The method of claim 96, wherein the first hydrocarbon stream comprises olefins having carbon numbers from 4 to 8.

99. The method of claim 96, wherein the first hydrocarbon stream comprises olefins having carbon numbers from 4 to 6.

100. The method of claim 96, wherein the first hydrocarbon stream comprises between about 50 percent and about 99 percent olefins.

101. The method of claim 96, wherein the first hydrocarbon stream comprises olefins, wherein the olefin composition comprises linear and branched olefins.

102. The method of claim 96, wherein the dimerization unit is operated at temperature between about 120 °C and about 200 °C.

103. The method of claim 96, wherein the dimerization unit is operated at temperature between about 150 °C and about 165 °C.

104. The method of claim 96, wherein the dimerization unit is configured to produce greater than 20 percent of a branched dimer compound.

105. The method of claim 96, wherein the second hydrocarbon stream comprises olefins, wherein the olefin composition comprises linear and branched olefins having carbon numbers from 10 to 16.

106. The method of claim 96, wherein the second hydrocarbon stream comprises olefins, wherein the olefin composition comprises linear and branched olefins having carbon numbers from 8 to 12.

107. The method of claim 96, wherein the second hydrocarbon stream comprises olefins, wherein the olefin composition comprises linear and branched olefins having carbon numbers from 10 to 16 and wherein at least a portion of the branched olefins comprises methyl and ethyl branches.

108. The method of claim 96, wherein a portion of the branched olefins comprise an average number of branches per total olefin molecules of at least 0.7.

109. The method of claim 96, wherein a portion of the branched olefins comprise methyl and ethyl branches.

110. The method of claim 96, wherein a portion of the branched olefins comprise an average number of branches per total olefin molecules of less than about 2.5.

111. The method of claim 96, wherein a portion of the branched olefins comprise an average number of branches per total olefin molecules of between about 0.7 and about 2.0.

112. The method of claim 96, wherein a portion of the branched olefins comprise an average number of branches per total olefin molecules of between about 0.7 and about 1.5.

113. The method of claim 96, wherein a portion of the branched olefins comprise an average number of branches per total olefin molecules of between about 1.0 and about 1.5.

114. The method of claim 96, wherein greater than about 50 percent of the branched groups on the branched olefins are methyl groups.

115. The method of claim 96, wherein less than about 10 percent of the branched groups on the branched olefins are ethyl groups.

116. The method of claim 96, wherein less than about 5 percent of the branched groups on the branched olefins are neither methyl or ethyl groups.

117. The method of claim 96, wherein the branched olefins have less than about 0.5 percent aliphatic quaternary carbon atoms.

118. The method of claim 96, wherein the branched olefins have less than about 0.3 percent aliphatic quaternary carbon atoms.

119. The method of claim 96, further comprising:

separating the produced dimerized olefins from the second hydrocarbon stream to form a produced dimerized olefins stream and a paraffins and unreacted olefins stream, wherein the paraffins and unreacted olefins stream comprises hydrocarbons of a carbon number less than 7; and

introducing at least a portion of the paraffins and unreacted olefins stream into the dimerization unit.

120. The method of claim 96, further comprising adjusting a ratio of olefins to paraffins introduced into the alkylation unit by adding at least a portion of a third hydrocarbon stream into the alkylation unit.

121. The method of claim 96, further comprising adjusting a ratio of olefins to paraffins introduced into the alkylation unit by adding at least a portion of a third hydrocarbon stream into the alkylation unit wherein the third hydrocarbon stream comprises greater than about 90 percent paraffins by weight.

122. The method of claim 96, further comprising adjusting a ratio of olefins to paraffins introduced into the alkylation unit by combining at least a portion of a third hydrocarbon stream with at least a portion of the second hydrocarbon stream upstream of the alkylation unit to form a combined stream and introducing the combined stream into the alkylation unit.

123. The method of claim 96, further comprising adjusting a ratio of olefins to paraffins introduced into the alkylation unit by combining at least a portion of a third hydrocarbon stream with at least a portion of the second hydrocarbon stream upstream of the alkylation unit to form a

combined stream and introducing the combined stream into the alkylation unit, and wherein the third hydrocarbon stream comprises greater than about 90 percent paraffins by weight.

124. The method of claim 96, further comprising adjusting a ratio of olefins to paraffins introduced into the alkylation unit by combining at least a portion of a third hydrocarbon stream with at least a portion of the second hydrocarbon stream upstream of the alkylation unit to form a combined stream and introducing the mixed stream into the alkylation unit, and wherein the third hydrocarbon stream comprises paraffins and olefins having a carbon number from 10 to 16.

125. The method of claim 96, wherein the alkylation unit is configured to produce greater than about 50 percent of monoalkylated aromatic hydrocarbons.

126. The method of claim 96, wherein the alkylation unit is configured to produce greater than about 85 percent of monoalkylated aromatic hydrocarbons.

127. The method of claim 96, wherein a molar ratio of the aromatic hydrocarbons to the branched olefins is between about 0.1 to about 2.0 in the alkylation unit.

128. The method of claim 96, wherein the alkylation unit is operated at a reaction temperature between about 30 °C and about 300 °C.

129. The method of claim 96, wherein the branched alkyl groups of the alkyl aromatic hydrocarbons comprise 0.5 percent or less aliphatic quaternary carbon atoms, and an average number of branches per alkyl group of at least 0.7, the branches comprising methyl and ethyl branches.

130. The method of claim 96, further comprising:

forming an alkylation reaction stream wherein the alkylation reaction stream comprises at least a portion of the aromatic hydrocarbons, at least a portion of the unreacted

components of the second hydrocarbon stream and at least a portion of the produced alkyl aromatic hydrocarbons;

separating alkyl aromatic hydrocarbons from the alkylation reaction stream to produce an unreacted hydrocarbons stream and an alkyl aromatic hydrocarbon stream; the unreacted hydrocarbons stream comprising at least a portion of the unreacted components of the second hydrocarbon stream and at least a portion of the aromatic hydrocarbons;

separating at least a portion of the paraffins and at least a portion of the olefins from the unreacted hydrocarbons stream to produce an aromatic hydrocarbons stream and a paraffins and unreacted olefins stream;

introducing at least a portion of the aromatic hydrocarbons stream into the alkylation unit.

131. The method of claim 130, further comprising separating olefins from the paraffins and unreacted olefins stream to produce an olefinic stream, wherein the olefins in the olefinic stream have a carbon number from 4 to 8 and introducing at least a portion of the olefinic stream into the dimerization unit.

132. The method of claim 96, further comprising introducing at least a portion of the alkyl aromatic hydrocarbons stream into a sulfonation unit, wherein the sulfonation unit is configured to sulfonate at least a portion of the alkyl aromatic hydrocarbons in the alkyl aromatic hydrocarbons stream to produce alkyl aromatic sulfonates and wherein at least a portion of the alkyl aromatic sulfonates produced comprise branched alkyl aromatic sulfonates.

133. A method for the production of alkyl aromatic hydrocarbons, comprising:

introducing a first hydrocarbon stream comprising olefins and paraffins into a dimerization unit, wherein the dimerization unit is configured to dimerize at least a portion of the olefins in the first hydrocarbon stream to produce dimerized olefins, and

wherein at least a portion of the unreacted components of the first hydrocarbon stream and the produced dimerized olefins form a second hydrocarbon stream, and wherein at least a portion of the dimerized olefins are branched olefins;

introducing at least a portion of the second hydrocarbon stream and aromatic hydrocarbons into an alkylation unit;

introducing a third hydrocarbon stream into an isomerization unit, wherein the isomerization unit is configured to isomerize at least a portion of linear olefins in the third hydrocarbon stream to branched olefins, and wherein at least a portion of the unreacted components of the third hydrocarbon stream and the produced branched olefins form a fourth hydrocarbon stream,

introducing at least a portion of the fourth hydrocarbon stream into the alkylation unit, wherein the alkylation unit is configured to alkylate at least a portion of the aromatic hydrocarbons with at least a portion of the olefins from the second hydrocarbon stream and the fourth hydrocarbon stream to produce alkyl aromatic hydrocarbons, wherein a least a portion of the produced alkyl aromatic hydrocarbons comprise a branched alkyl group.

134. The method of claim 133, wherein the first hydrocarbon stream is produced from a Fischer-Tropsch process.

135. The method of claim 133, wherein the first hydrocarbon stream comprises olefins.

136. The method of claim 133, wherein the second hydrocarbon stream comprises olefins having a carbon number from 10 to 16.

137. The method of claim 133, wherein a portion of the branched olefins comprise an average number of branches per total olefin molecules of at least 0.7.

138. The method of claim 133, wherein a portion of the branched olefins comprise methyl and ethyl branches.

139. The method of claim 133, wherein a portion of the branched olefins comprise an average number of branches per total olefin molecules of less than about 2.5.

140. The method of claim 133, wherein a portion of the branched olefins comprise an average number of branches per total olefin molecules of between about 0.7 and about 2.0.

141. The method of claim 133, wherein a portion of the branched olefins comprise an average number of branches per total olefin molecules of between about 0.7 and about 1.5.

142. The method of claim 133, wherein a portion of the branched olefins comprise an average number of branches per total olefin molecules of between about 1.0 and about 1.5.

143. The method of claim 133, wherein greater than about 50 percent of the branched groups on the branched olefins are methyl groups.

144. The method of claim 133, wherein less than about 10 percent of the branched groups on the branched olefins are ethyl groups.

145. The method of claim 133, wherein less than about 5 percent of the branched groups on the branched olefins are neither methyl or ethyl groups.

146. The method of claim 133, wherein the branched olefins have less than about 0.5 percent aliphatic quaternary carbon atoms.

147. The method of claim 133, wherein the branched olefins have less than about 0.3 percent aliphatic quaternary carbon atoms.

148. The method of claim 133, further comprising:

separating the produced dimerized olefins from the second hydrocarbon stream to form a produced dimerized olefins stream and a paraffins and unreacted olefins stream, wherein the paraffins and unreacted olefins stream comprises hydrocarbons of a carbon number less than 7; and

introducing at least a portion of the paraffins and unreacted olefins stream into the dimerization unit.

149. The method of claim 133, wherein the alkylation unit is configured to produce greater than about 50 percent of monoalkylated aromatic hydrocarbons.

150. The method of claim 133, wherein the alkylation unit is configured to produce greater than about 85 percent of monoalkylated aromatic hydrocarbons.

151. The method of claim 133, wherein a molar ratio of the aromatic hydrocarbons to the branched olefins is between about 0.1 to about 2.0 in the alkylation unit.

152. The method of claim 133, wherein the alkylation unit is operated at a reaction temperature between about 30 °C and about 300 °C.

153. The method of claim 133, wherein the branched alkyl groups of the alkyl aromatic hydrocarbons comprise 0.5 percent or less aliphatic quaternary carbon atoms, and an average number of branches per alkyl group of at least 0.7, the branches comprising methyl and ethyl branches.

154. The method of claim 133, wherein introducing at least a portion of the fourth hydrocarbon stream into the alkylation unit comprises combining at least a portion of the fourth

hydrocarbon stream with at least a portion of the second hydrocarbon stream to produce a combined stream upstream of the alkylation unit.

155. The method of claim 133, further comprising adjusting a ratio of olefins to paraffins introduced into the alkylation unit by adding at least a portion of a fifth hydrocarbon stream into the alkylation unit.

156. The method of claim 133, further comprising adjusting a ratio of olefins to paraffins introduced into the alkylation unit by adding at least a portion of a fifth hydrocarbon stream into the alkylation unit and wherein the fifth hydrocarbon stream comprises greater than about 90 percent paraffins by weight.

157. The method of claim 133, further comprising adjusting a ratio of olefins to paraffins introduced into the alkylation unit by adding at least a portion of a fifth hydrocarbon stream to at least a portion of the second hydrocarbon stream upstream of the alkylation unit.

158. The method of claim 133, further comprising adjusting a ratio of olefins to paraffins introduced into the alkylation unit by adding at least a portion of a fifth hydrocarbon stream to at least a portion of the second hydrocarbon stream upstream of the alkylation unit to form a combined stream and wherein the fifth hydrocarbon stream comprises greater than about 90 percent paraffins by weight.

159. The method of claim 133, further comprising:

forming an alkylation reaction stream wherein the alkylation reaction stream comprises at least a portion of the aromatic hydrocarbons, at least a portion of the unreacted components of the second hydrocarbon stream and at least a portion of the produced alkyl aromatic hydrocarbons;

separating alkyl aromatic hydrocarbons from the alkylation reaction stream to produce an unreacted hydrocarbons stream and an alkyl aromatic hydrocarbon stream; the unreacted hydrocarbons stream comprising at least a portion of the unreacted components of the second hydrocarbon stream and at least a portion of the aromatic hydrocarbons;

separating at least a portion of the paraffins and at least a portion of the olefins from the unreacted hydrocarbons stream to produce an aromatic hydrocarbons stream and a paraffins and unreacted olefins stream; and

introducing at least a portion of the paraffins and unreacted olefins stream into the isomerization unit.

160. The method of claim 159, further comprising introducing at least a portion of the alkyl aromatic hydrocarbons stream into a sulfonation unit, wherein the sulfonation unit is configured to sulfonate at least a portion of the alkyl aromatic hydrocarbons in the alkyl aromatic hydrocarbons stream to produce alkyl aromatic sulfonates and wherein at least a portion of the alkyl aromatic sulfonates produced comprise branched alkyl aromatic sulfonates.

161. The method of claim 159, further comprising separating the olefins from the paraffins and unreacted olefins stream to produce an olefinic stream, wherein the average carbon number of the olefins in the olefinic stream is from 4 to 8 and introducing at least a portion of the olefinic stream into the dimerization unit.

162. A method for the production of alkyl aromatic hydrocarbons, comprising:

introducing a first hydrocarbon stream comprising olefins and paraffins into a hydrogenation unit, wherein the hydrogenation unit is configured to hydrogenate at least a portion of olefins in the first hydrocarbon stream to paraffins, and wherein at least a portion of the unreacted components of the first hydrocarbon stream and at least a portion of the hydrogenated olefins form a second hydrocarbon stream,

introducing the second hydrocarbon stream into a dehydrogenation unit, wherein the dehydrogenation unit is configured to dehydrogenate at least a portion of paraffins in the second hydrocarbon stream to olefins, and wherein at least a portion of the unreacted components of the second hydrocarbon stream and at least a portion of the olefins from the dehydrogenation process form a third hydrocarbon stream,

introducing the third hydrocarbon stream into an isomerization unit, wherein the isomerization unit is configured to isomerize at least a portion of olefins in the third hydrocarbon stream to branched olefins, and wherein at least a portion of the unreacted components of the third hydrocarbon stream and at least a portion of the produced branched olefins form a fourth hydrocarbon stream;

introducing at least a portion of the fourth hydrocarbon stream and aromatic hydrocarbons into an alkylation unit, wherein the alkylation unit is configured to alkylate at least a portion of the aromatic hydrocarbons with at least a portion of the olefins in the fourth hydrocarbon stream to produce alkyl aromatic hydrocarbons, wherein at least a portion of the produced alkyl aromatic hydrocarbons comprise a branched alkyl group.

163. The method of claim 162, wherein the first hydrocarbon stream is produced from a Fischer-Tropsch process.

164. The method of claim 162, wherein the first hydrocarbon stream comprises olefins and paraffins having carbon numbers from 10 to 13.

165. The method of claim 162, wherein the first hydrocarbon stream comprises olefins and paraffins having carbon numbers from 10 to 16.

166. The method of claim 162, wherein the hydrogenation unit is operated at a temperature between about 175 °C and about 250 °C.

167. The method of claim 162, wherein the hydrogenation unit is operated at a hydrogen flow rate between about 250 NL/L/hr and about 5000 NL/L/hr.

168. The method of claim 162, wherein the hydrogenation unit is operated at a pressure between about 10 atmospheres and about 50 atmospheres.

169. The method of claim 162, wherein the dehydrogenation unit is operated at a temperature between about 300 °C and about 700 °C.

170. The method of claim 162, wherein the dehydrogenation unit is operated at a pressure between about 1.0 atmosphere and about 15 atmospheres.

171. The method of claim 162, wherein a residence time of at least a portion of the unreacted hydrocarbons stream in the dehydrogenation unit is such that the conversion level of the paraffins in the unreacted hydrocarbons stream composition to olefins is less than about 50 mole percent.

172. The method of claim 162, wherein the isomerization unit is operated at a reaction temperature between about 200 °C and about 500 °C.

173. The method of claim 162, wherein the isomerization unit is operated at a reaction pressure between about 0.1 atmosphere and about 10 atmospheres.

174. The method of claim 162, wherein at least a portion of the branched olefins comprise an average number of branches per total olefin molecules of at least about 0.7.

175. The method of claim 162, wherein at least a portion of the branched olefins comprise methyl and ethyl branches.

176. The method of claim 162, wherein at least a portion of the branched olefins comprise an average number of branches per total olefin molecules of less than about 2.5.

177. The method of claim 162, wherein at least a portion of the branched olefins comprise an average number of branches per total olefin molecules of between about 0.7 and about 2.0.

178. The method of claim 162, wherein at least a portion of the branched olefins comprise an average number of branches per total olefin molecules of between about 0.7 and about 1.5.

179. The method of claim 162, wherein at least a portion of the branched olefins comprise an average number of branches per total olefin molecules of between about 1.0 and about 1.5.

180. The method of claim 162, wherein greater than about 50 percent of the branched groups on the branched olefins are methyl groups.

181. The method of claim 162, wherein less than about 10 percent of the branched groups on the branched olefins are ethyl groups.

182. The method of claim 162, wherein less than about 5 percent of the branched groups on the branched olefins are neither methyl or ethyl groups.

183. The method of claim 162, wherein the branched olefins have less than about 0.5 percent aliphatic quaternary carbon atoms.

184. The method of claim 162, wherein the branched olefins have less than about 0.3 percent aliphatic quaternary carbon atoms.

185. The method of claim 162, wherein the alkylation unit is configured to produce greater than about 50 percent of monoalkylated aromatic hydrocarbons.

186. The method of claim 162, wherein the alkylation unit is configured to produce greater than about 85 percent of monoalkylated aromatic hydrocarbons.

187. The method of claim 162, wherein a molar ratio of the aromatic hydrocarbons to the branched olefins is between about 0.1 and about 2.0 in the alkylation unit.

188. The method of claim 162, wherein the alkylation unit is operated at a reaction temperature between about 30 °C and about 300 °C.

189. The method of claim 162, wherein the aromatic hydrocarbons comprise benzene.

190. The method of claim 162, wherein the alkyl aromatic hydrocarbons comprise alkylbenzenes.

191. The method of claim 162, wherein the branched alkyl groups of the alkyl aromatic hydrocarbons comprise 0.5 percent or less aliphatic quaternary carbon atoms, and an average number of branches per alkyl group of at least 0.7, the branches comprising methyl and ethyl branches.

192. The method of claim 162, further comprising:

forming an alkylation reaction stream wherein the alkylation reaction stream comprises at least a portion of the aromatic hydrocarbons, at least a portion of the unreacted components of the fourth hydrocarbon stream and at least a portion of the produced alkyl aromatic hydrocarbons;

separating alkyl aromatic hydrocarbons from the alkylation reaction stream to produce an unreacted hydrocarbons stream and an alkyl aromatic hydrocarbon stream; the unreacted hydrocarbons stream comprising at least a portion of the unreacted components of the fourth hydrocarbon stream and at least a portion of the aromatic hydrocarbons;

separating at least a portion of the paraffins and at least a portion of the olefins from the unreacted hydrocarbons stream to produce an aromatic hydrocarbons stream and a paraffins and unreacted olefins stream; and

introducing at least a portion of the paraffins and unreacted olefins stream into the dehydrogenation unit.

193. The method of claim 192, wherein introducing at least a portion of the paraffins and unreacted olefins stream into the dehydrogenation unit comprises combining at least a portion of the paraffins and unreacted olefins stream with at least a portion of the second hydrocarbon stream to produce a combined stream upstream of the dehydrogenation unit and introducing at least a portion of the combined stream into the dehydrogenation unit.

194. The method of claim 192, further comprising: introducing at least a portion of the alkyl aromatic hydrocarbon stream into a sulfonation unit, wherein the sulfonation unit is configured to sulfonate at least a portion of the alkyl aromatic hydrocarbons in the alkyl aromatic hydrocarbon stream to produce alkyl aromatic sulfonates, wherein at least a portion of the alkyl aromatic sulfonates produced comprise branched alkyl aromatic sulfonates.

195. A method for the production of alkyl aromatic hydrocarbons, comprising:

introducing a first hydrocarbon stream comprising olefins and paraffins into a hydrogenation unit, wherein the hydrogenation unit is configured to hydrogenate at least a portion of olefins in the first hydrocarbon stream to paraffins, and wherein at least a portion of the unreacted components of the first hydrocarbon stream and at least a portion of the hydrogenated olefins form a second hydrocarbon stream;

introducing the second hydrocarbon stream into a dehydrogenation unit, wherein the dehydrogenation unit is configured to dehydrogenate at least a portion of paraffins in the second hydrocarbon stream to olefins, and wherein at least a portion of the unreacted

components of the second hydrocarbon stream and at least a portion of the olefins from the dehydrogenation process form a third hydrocarbon stream,

introducing the third hydrocarbon stream into a dimerization unit, wherein the dimerization unit is configured to dimerize at least a portion of the olefins in the third hydrocarbon stream to produce dimerized olefins, and wherein at least a portion of the unreacted components of the third hydrocarbon stream and the produced dimerized olefins form a fourth hydrocarbon stream, and wherein at least a portion of the dimerized olefins are branched olefins;

introducing at least a portion of the fourth hydrocarbon stream and aromatic hydrocarbons into an alkylation unit; wherein the alkylation unit is configured to alkylate at least a portion of the aromatic hydrocarbons with at least a portion of the olefins in the fourth hydrocarbon stream to produce alkyl aromatic hydrocarbons, wherein at least a portion of the produced alkyl aromatic hydrocarbons comprise a branched alkyl group.

196. The method of claim 195, wherein the first hydrocarbon stream is produced from a Fischer-Tropsch process.

197. The method of claim 195, wherein the first hydrocarbon stream comprises olefins and paraffins having carbon numbers from 4 to 8.

198. The method of claim 195, wherein the first hydrocarbon stream comprises olefins and paraffins having carbon numbers from 4 to 6.

199. The method of claim 195, wherein the hydrogenation unit is operated at a temperature between about 175 °C and about 250 °C.

200. The method of claim 195, wherein the hydrogenation unit is operated at a hydrogen flow rate between about 250 NL/L/hr and about 5000 NL/L/hr.

201. The method of claim 195, wherein the hydrogenation unit is operated at a pressure between about 10 atmospheres and about 50 atmospheres.

202. The method of claim 195, wherein the dehydrogenation unit is operated at a temperature between about 300 °C and about 700 °C.

203. The method of claim 195, wherein the dehydrogenation unit is operated at a pressure between about 1.0 atmosphere and about 15 atmospheres.

204. The method of claim 195, wherein a residence time at least a portion of the unreacted hydrocarbons stream in the dehydrogenation unit is such that the conversion level of the paraffins in the unreacted hydrocarbons stream composition to olefins is less than about 50 mole percent.

205. The method of claim 195, wherein the dimerization unit is operated at temperature between about 120 °C and about 200 °C.

206. The method of claim 195, wherein the dimerization unit is operated at temperature between about 150 °C and about 165 °C.

207. The method of claim 195, wherein the dimerization unit is configured to produce greater than 20 percent of a branched dimer.

208. The method of claim 195, wherein at least a portion of the branched olefins comprise an average number of branches per total olefin molecules of at least 0.7.

209. The method of claim 195, wherein at least a portion of the branched olefins comprise methyl and ethyl branches.

210. The method of claim 195, wherein at least a portion of the branched olefins comprise an average number of branches per total olefin molecules of less than about 2.5.

211. The method of claim 195, wherein at least a portion of the branched olefins comprise an average number of branches per total olefin molecules of between about 0.7 and about 2.0.

212. The method of claim 195, wherein at least a portion of the branched olefins comprise an average number of branches per total olefin molecules of between about 0.7 and about 1.5.

213. The method of claim 195, wherein at least a portion of the branched olefins comprise an average number of branches per total olefin molecules of between about 1.0 and about 1.5.

214. The method of claim 195, wherein greater than about 50 percent of the branched groups on the branched olefins are methyl groups.

215. The method of claim 195, wherein less than about 10 percent of the branched groups on the branched olefins are ethyl groups.

216. The method of claim 195, wherein less than about 5 percent of the branched groups on the branched olefins are neither methyl or ethyl groups.

217. The method of claim 195, wherein the branched olefins have less than about 0.5 percent aliphatic quaternary carbon atoms.

218. The method of claim 195, wherein the branched olefins have less than about 0.3 percent aliphatic quaternary carbon atoms.

219. The method of claim 195, wherein the alkylation unit is configured to produce greater than about 50 percent of monoalkylated aromatic hydrocarbons.

220. The method of claim 195, wherein the alkylation unit is configured to produce greater than about 85 percent of monoalkylated aromatic hydrocarbons.

221. The method of claim 195, wherein a molar ratio of the aromatic hydrocarbons to the branched olefins is between about 0.1 and about 2.0 in the alkylation unit.

222. The method of claim 195, wherein the alkylation unit is operated at a reaction temperature between about 30 °C and about 300 °C.

223. The method of claim 195, wherein the aromatic hydrocarbons comprise benzene.

224. The method of claim 195, wherein the alkyl aromatic hydrocarbons comprise alkylbenzenes.

225. The method of claim 195, wherein the branched alkyl groups of the alkyl aromatic hydrocarbons comprise 0.5 percent or less aliphatic quaternary carbon atoms, and an average number of branches per alkyl group of at least 0.7, the branches comprising methyl and ethyl branches.

226. The method of claim 195, further comprising:

separating the produced dimerized olefins from the fourth hydrocarbon stream to form a produced dimerized olefins stream and a paraffins and unreacted olefins stream, wherein the paraffins and unreacted olefins stream comprises hydrocarbons of a carbon number less than 7; and

introducing at least a portion of the paraffins and unreacted olefins stream into the dehydrogenation unit.

227. The method of claim 195, further comprising:

forming an alkylation reaction stream wherein the alkylation reaction stream comprises at least a portion of the aromatic hydrocarbons, at least a portion of the unreacted components of the fourth hydrocarbon stream and at least a portion of the produced alkyl aromatic hydrocarbons;

separating alkyl aromatic hydrocarbons from the alkylation reaction stream to produce an unreacted hydrocarbons stream and an alkyl aromatic hydrocarbon stream; the unreacted hydrocarbons stream comprising at least a portion of the unreacted components of the fourth hydrocarbon stream and at least a portion of the aromatic hydrocarbons;

separating at least a portion of the paraffins and at least a portion of the olefins from the unreacted hydrocarbons stream to produce an aromatic hydrocarbons stream and a paraffins and unreacted olefins stream; and

introducing at least a portion of the aromatic hydrocarbons stream into the alkylation unit.

228. The method of claim 227, further comprising, separating olefins from the paraffins and unreacted olefins stream to produce an olefinic stream, wherein the olefins in the olefinic stream have an average carbon number from 4 to 8.

229. The method of claim 227, further comprising, separating olefins from the paraffins and unreacted olefins stream to produce an olefinic stream, wherein the olefins in the olefinic stream have an average carbon number from 4 to 8 and wherein introducing at least a portion of the olefinic stream into the dehydrogenation unit comprises combining at least a portion of the olefinic stream with at least a portion of the second hydrocarbon stream to produce a combined stream upstream of the dehydrogenation unit and introducing at least a portion of the combined stream into the dehydrogenation unit.

230. The method of claim 227, further comprising: introducing at least a portion of the alkyl aromatic hydrocarbon stream into a sulfonation unit, wherein the sulfonation unit is configured to sulfonate at least a portion of the alkyl aromatic hydrocarbons in the alkyl aromatic hydrocarbon stream to produce alkyl aromatic sulfonates, wherein at least a portion of the alkyl aromatic sulfonates produced comprise branched alkyl aromatic sulfonates.

231. The method of claim 195, further comprising:

introducing a fifth hydrocarbon stream into an isomerization unit, wherein the isomerization unit is configured to isomerize at least a portion of linear olefins in the fifth hydrocarbon stream to branched olefins, and wherein at least a portion of the unreacted components of the fifth hydrocarbon stream and the produced branched olefins form a sixth hydrocarbon stream,

introducing at least a portion of the sixth hydrocarbon stream into the alkylation unit, wherein the alkylation unit is configured to alkylate at least a portion of the aromatic hydrocarbons with at least a portion of the olefins from the fourth hydrocarbon stream and the sixth hydrocarbon stream to produce alkyl aromatic hydrocarbons, wherein a least a portion of the produced alkyl aromatic hydrocarbons comprise a branched alkyl group.

232. A method for the production of alkyl aromatic hydrocarbons, comprising:

introducing a first hydrocarbon stream comprising olefins and paraffins into a hydrogenation unit, wherein the hydrogenation unit is configured to hydrogenate at least a portion of olefins in the first hydrocarbon stream to paraffins, and wherein at least a portion of the unreacted components of the first hydrocarbon stream and at least a portion of the hydrogenated olefins form a second hydrocarbon stream,

introducing the second hydrocarbon stream into a dehydrogenation-isomerization unit, wherein the dehydrogenation-isomerization unit is configured to dehydrogenate at least a

portion of the paraffins in the first hydrocarbon stream to olefins, and wherein the dehydrogenation-isomerization unit is further configured to isomerize at least a portion of linear olefins to branched olefins, and wherein at least a portion of the unreacted components of the second hydrocarbon stream and at least a portion of the products of the dehydrogenation and isomerization reactions form a third hydrocarbon stream, the third hydrocarbon stream comprising olefins and paraffins, and wherein at least a portion of the olefins in the third hydrocarbon stream are branched olefins;

introducing at least a portion of the third hydrocarbon stream and aromatic hydrocarbons into an alkylation unit, wherein the alkylation unit is configured to alkylate at least a portion of the aromatic hydrocarbons with at least a portion of the olefins in the third hydrocarbon stream to produce alkyl aromatic hydrocarbons, wherein at least a portion of the produced alkyl aromatic hydrocarbons comprise a branched alkyl group.

233. The method of claim 232, wherein the first hydrocarbon stream is produced from a Fischer-Tropsch process.

234. The method of claim 232, wherein the first hydrocarbon stream comprises olefins and paraffins having carbon numbers from 10 to 13.

235. The method of claim 232, wherein the first hydrocarbon stream comprises olefins and paraffins having carbon number from 10 to 16.

236. The method of claim 232, wherein the hydrogenation unit is operated at a temperature between about 175 °C and about 250 °C.

237. The method of claim 232, wherein the hydrogenation unit is operated at a hydrogen flow rate between about 250 NL/L/hr and about 5000 NL/L/hr.

238. The method of claim 232, wherein the hydrogenation unit is operated at a pressure between about 10 atmospheres and about 50 atmospheres.

239. The method of claim 232, wherein the dehydrogenation-isomerization unit is operated at a temperature of between about 300 °C and about 500 °C.

240. The method of claim 232, wherein the dehydrogenation-isomerization unit is configured to operate at a pressure of between about 0.10 atmosphere and about 15 atmospheres.

241. The method of claim 232, wherein a residence time at least a portion of the unreacted hydrocarbons stream in the dehydrogenation-isomerization unit is such that the conversion level of the paraffins in the unreacted hydrocarbons stream composition to olefins is less than about 50 mole percent.

242. The method of claim 232, wherein a portion of the branched olefins comprise an average number of branches per total olefin molecules of at least 0.7.

243. The method of claim 232, wherein a portion of the branched olefins comprise methyl and ethyl branches.

244. The method of claim 232, wherein a portion of the branched olefins comprise an average number of branches per total olefin molecules of less than about 2.5.

245. The method of claim 232, wherein a portion of the branched olefins comprise an average number of branches per total olefin molecules of between about 0.7 and about 2.0.

246. The method of claim 232, wherein a portion of the branched olefins comprise an average number of branches per total olefin molecules of between about 0.7 and about 1.5.

247. The method of claim 232, wherein a portion of the branched olefins comprise an average number of branches per total olefin molecules of between about 1.0 and about 1.5.

248. The method of claim 232, wherein greater than about 50 percent of the branched groups on the branched olefins are methyl groups.

249. The method of claim 232, wherein less than about 10 percent of the branched groups on the branched olefins are ethyl groups.

250. The method of claim 232, wherein less than about 5 percent of the branched groups on the branched olefins are neither methyl or ethyl groups.

251. The method of claim 232, wherein the branched olefins have less than about 0.5 percent aliphatic quaternary carbon atoms.

252. The method of claim 232, wherein the branched olefins have less than about 0.3 percent aliphatic quaternary carbon atoms.

253. The method of claim 232, wherein the alkylation unit is configured to produce greater than about 50 percent of monoalkylated aromatic hydrocarbons.

254. The method of claim 232, wherein the alkylation unit is configured to produce greater than about 85 percent of monoalkylated aromatic hydrocarbons.

255. The method of claim 232, wherein a molar ratio of the aromatic hydrocarbons to the branched olefins is between about 0.1 and about 2.0 in the alkylation unit.

256. The method of claim 232, wherein the alkylation unit is operated at a reaction temperature between about 30 °C and about 300 °C.

257. The method of claim 232, wherein the aromatic hydrocarbons comprise benzene.

258. The method of claim 232, wherein the alkyl aromatic hydrocarbons comprise alkylbenzenes.

259. The method of claim 232, wherein the branched alkyl groups of the alkyl aromatic hydrocarbons comprise 0.5 percent or less aliphatic quaternary carbon atoms, and an average number of branches per alkyl group of at least 0.7, the branches comprising methyl and ethyl branches.

260. The method of claim 232, further comprising:

forming an alkylation reaction stream wherein the alkylation reaction stream comprises at least a portion of the aromatic hydrocarbons, at least a portion of the unreacted components of the third hydrocarbon stream and at least a portion of the produced alkyl aromatic hydrocarbons;

separating alkyl aromatic hydrocarbons from the alkylation reaction stream to produce an unreacted hydrocarbons stream and an alkyl aromatic hydrocarbon stream; the unreacted hydrocarbons stream comprising at least a portion of the unreacted components of the third hydrocarbon stream and at least a portion of the aromatic hydrocarbons;

separating at least a portion of the paraffins and at least a portion of the olefins from the unreacted hydrocarbons stream to produce an aromatic hydrocarbons stream and a paraffins and unreacted olefins stream; and

introducing at least a portion of the paraffins and unreacted olefins stream into the dehydrogenation-isomerization unit.

261. The method of claim 260, wherein introducing at least a portion of the paraffins and unreacted olefins stream into the dehydrogenation-isomerization unit comprises combining at least a portion of the paraffins and unreacted olefins stream with at least a portion of the second hydrocarbon stream to produce a combined stream upstream of the dehydrogenation-isomerization unit and introducing at least a portion of the combined stream into the dehydrogenation-isomerization unit.

262. The method of claim 232, further comprising: introducing at least a portion of the alkyl aromatic hydrocarbon stream into a sulfonation unit, wherein the sulfonation unit is configured to sulfonate at least a portion of the alkyl aromatic hydrocarbons in the alkyl aromatic hydrocarbon stream to produce alkyl aromatic sulfonates, wherein at least a portion of the alkyl aromatic sulfonates produced comprise branched alkyl aromatic sulfonates.

263. The method of claim 232, wherein the dehydrogenation-isomerization unit comprises a dehydrogenation-isomerization catalyst configured to catalyze both dehydrogenation reactions and isomerization reactions in the dehydrogenation-isomerization unit, the catalyst comprising a hydrogen form of a zeolite have a ferrierite isotypic framework structure, a binder, a coke-oxidizing compound, and a paraffin dehydrogenation promoting compound.

264. The method of claim 263, wherein the coke-oxidizing compound comprises chrome oxide, iron oxide or noble metals or mixtures thereof.

265. The method of claim 263, wherein the coke-oxidizing compound comprises a platinum, palladium, iridium, ruthenium, osmium or rhodium or mixtures thereof.

266. The method of claim 263, wherein the coke-oxidizing compound is a noble metal.

267. The method of claim 263, wherein the paraffin dehydrogenation promoting compound is a noble metal.

268. The method of claim 263, wherein the paraffin dehydrogenation promoting compound is platinum.

269. The method of claim 263, wherein the binder is selected from natural clays, alumina and silica-alumina.

270. The method of claim 263, wherein the binder is alumina.

271. The method of claim 232, wherein the dehydrogenation-isomerization unit comprises a plurality of zones, wherein the plurality of zones comprises a first reaction zone and a second reaction zone, wherein the first reaction zone is configured to dehydrogenate at least a portion of paraffins to olefins, and wherein the second reaction zone is configured to isomerize at least a portion of linear olefins to branched olefins, and wherein at least a portion of the unreacted components of the first hydrocarbon stream and at least a portion of the products of the dehydrogenation and isomerization reactions form a second hydrocarbon stream.

272. The method of claim 232, wherein the dehydrogenation-isomerization unit comprises a plurality of zones, wherein the plurality of zones comprises a first reaction zone and a second reaction zone, wherein the first reaction zone is configured to dehydrogenate at least a portion of paraffins to olefins, and wherein the second reaction zone is configured to isomerize at least a portion of linear olefins to branched olefins; and wherein the first reaction zone is operated at a temperature of between about 300 °C and about 600 °C.

273. The method of claim 232, wherein the dehydrogenation-isomerization unit comprises t a plurality of zones, wherein the plurality of zones comprises a first reaction zone and a second reaction zone, wherein the first reaction zone is configured to dehydrogenate at least a portion of paraffins to olefins, and wherein the second reaction zone is configured to isomerize at least a portion of linear olefins to branched olefins, and wherein the first reaction zone is operated at a temperature of between about 350 °C and about 550 °C.

274. The method of claim 232, wherein the dehydrogenation-isomerization unit comprises a plurality of zones, wherein the plurality of zones comprises a first reaction zone and a second reaction zone, wherein the first reaction zone is configured to dehydrogenate at least a portion of paraffins to olefins, and wherein the second reaction zone is configured to isomerize at least a portion of linear olefins to branched olefins and wherein the first reaction zone is operated at a total reaction pressure between about 1.0 atmospheres and about 5.0 atmospheres.

275. The method of claim 232, further comprising introducing hydrogen into the first hydrocarbon stream.

276. The method of claim 232, wherein the dehydrogenation-isomerization unit comprises a plurality of zones, wherein the plurality of zones comprises a first reaction zone and a second reaction zone, wherein the first reaction zone is configured to dehydrogenate at least a portion of paraffins to olefins, wherein the second reaction zone is configured to isomerize at least a portion of linear olefins to branched olefins and wherein a residence time of at least a portion of the first hydrocarbon stream in the first reaction zone is such that the conversion level of the paraffins to olefins is less than about 50 mole percent.

277. The method of claim 271, further comprising introducing at least a portion of the first hydrocarbon stream exiting the first reaction zone into a heat exchanger, wherein the heat exchanger is configured to remove heat from a portion of the first hydrocarbon stream before it enters the second reaction zone.

278. The method of claim 232, wherein the dehydrogenation-isomerization unit comprises a plurality of zones, wherein the plurality of zones comprises a first reaction zone and a second reaction zone, wherein the first reaction zone is configured to dehydrogenate at least a portion of paraffins to olefins, wherein the second reaction zone is configured to isomerize at least a portion of linear olefins to branched olefins; and wherein the second reaction zone is operated at a temperature range of about 200 °C to about 500 °C.

279. The method of claim 232, wherein the dehydrogenation-isomerization unit comprises a plurality of zones, wherein the plurality of zones comprises a first reaction zone and a second reaction zone, wherein the first reaction zone is configured to dehydrogenate at least a portion of paraffins to olefins, wherein the second reaction zone is configured to isomerize at least a portion of linear olefins to branched olefins; and wherein the second reaction zone is operated at a hydrocarbon partial pressure between about 0.1 atmosphere and about 10 atmospheres.

280. The method of claim 232, wherein the dehydrogenation-isomerization unit comprises a plurality of zones, wherein the plurality of zones comprises a first reaction zone and a second reaction zone, wherein the first reaction zone is configured to dehydrogenate at least a portion of paraffins to olefins, wherein the second reaction zone is configured to isomerize at least a portion of linear olefins to branched olefins; and wherein the second reaction zone is operated at a hydrocarbon partial pressure between about 0.5 atmosphere and about 2 atmospheres.

281. The method of claim 232, wherein the dehydrogenation-isomerization unit comprises a stacked bed catalyst configuration, wherein the stacked bed catalyst comprises a dehydrogenation catalyst and an isomerization catalyst.